

COPY

56. The method of claim 52 further comprising providing an insert across a central opening in the plug for closure thereof, wherein the insert is a shearable member adapted for shearing and opening the central opening when a predetermined pressure is applied across the shearable member or a substantially non-shearable member adapted for substantially permanent closure of the central opening.

57. The method of claim 52 further comprising:
providing an additional plug in the casing having two axially-spaced, conical wipers thereon, wherein each wiper on the additional plug engages the inner surface in a manner so that the wiper is deflected into a substantially cylindrical shape in engagement with the inner surface; and
applying pressure from one end of the casing to move the additional plug within the casing.

58. The method of claim 57 wherein the plugs are identical.

59. The method of claim 57 wherein one of the wipers overlaps the other wiper on each plug.

60. The method of claim 57 wherein the wiper closest to the one end of the casing is overlapped by the other wiper on each plug.

61. The method of claim 57 further comprising providing a shearable insert across a central opening in the plug closest to the end of the casing for closure thereof, the insert being adapted for shearing and opening the central opening in the latter plug when a predetermined pressure is applied across the shearable insert, and further comprising providing a substantially non-shearable insert across a central opening in the other plug for substantially permanent closure of the opening in the second plug.

COPY

62. A method for cementing a casing containing drilling mud in a well comprising:
introducing a first plug into one end of the casing;
introducing cement into the one end of the casing to force the first plug
downwardly in the casing to displace the mud from the casing;
providing at least two axially spaced wipers on the first plug so that, as the plug
passes downwardly in the casing, it wipes the inner surface of the casing of any
accumulated mud, wherein each wiper of the first plug is sized to engage the inner
surface in a manner so that it is deflected into a substantially cylindrical wiping
engagement with the inner surface;
terminating the step of introducing the cement into the casing;
introducing a second plug into the casing end;
forcing the second plug downwardly through the casing so that it forces the
cement and the first plug downwardly in the casing;
establishing a differential pressure across the first plug to open the first plug and
allow the cement to pass through the first plug and exit the other end of the casing; and
providing at least two axially spaced wipers on the second plug so that as the
second plug passes downwardly in the casing, it wipes the inner surface of the casing
of any accumulated cement, wherein each wiper of the second plug is sized to engage
the inner surface in a manner so that it is deflected into a substantially cylindrical wiping
engagement with the inner surface.
63. The method of claim 62 wherein one of the wipers of each plug overlaps the
other wiper of the same plug.
64. The method of claim 62 wherein the wiper of each plug closest to the one end of
the casing is overlapped by the other wiper of the same plug.
65. The method of claim 62 wherein the first and second plugs are identical.
66. The method of claim 62 further comprising providing a shearable insert across a
central opening in the first plug for closure thereof and adapted for shearing and
opening the central opening in the first plug when a predetermined pressure is applied

COPY

across the shearable insert, and further comprising providing a substantially non-shearable insert across a central opening in the second plug for substantially permanent closure of the opening in the second plug.

67. The method of claim 62 wherein the second plug is forced downwardly in the casing by introducing a fluid into the casing.

68. The method of claim 62 wherein the second plug forces the cement from the casing into an annulus formed between the casing and the well.

69. The method of claim 62 further comprising providing a float shoe in the casing which stops the downward movement of the first plug and causes the differential pressure.

70. A method for wiping the inner surface of a casing comprising:
providing a plug in the casing having at least two axially-spaced wipers sized to engage and wipe the inner surface; and
applying pressure from one end of the casing to move the first plug within the casing wherein as the wiper closest to the one end of the casing wears, the pressure will be applied to the other wiper.

71. The method of claim 70 wherein one of the wipers overlaps the other wiper.

72. The method of claim 70 wherein the wiper closest to the one end of the casing is overlapped by the other wiper.

73. The method of claim 70 further comprising providing an insert across a central opening in the plug for closure thereof, wherein the insert is a shearable member adapted for shearing and opening the central opening when a predetermined pressure is applied across the shearable member or a substantially non-shearable member adapted for substantially permanent closure of the central opening.

COPY

74. The method of claim 70 further comprising:
providing an additional plug in the casing having at least two axially-spaced wipers sized to engage and wipe the inner surface; and
applying pressure from one end of the casing to move the additional plug within the casing so that, as the wiper on the plug closest to the one end of the casing wears, the pressure will be applied to the other wiper on the additional plug.
75. The method of claim 74 wherein the plugs are identical.
76. The method of claim 74 wherein one of the wipers overlaps the other wiper on each plug.
77. The method of claim 74 wherein the wiper closest to the one end of the casing is overlapped by the other wiper on each plug.
78. The method of claim 74 wherein upon engagement with the inner surface, each wiper on the plugs is deflected into substantially cylindrical wiping engagement with the inner surface.
79. The method of claim 74 further comprising providing a shearable insert across a central opening in the plug closest to the end of the casing for closing the central opening and adapted for shearing and opening the central opening in the one plug when a predetermined pressure is applied across the shearable insert, and further comprising providing a substantially non-shearable insert across a central opening in the other plug for substantially permanent closure of the opening in the other plug.
80. A method for cementing a casing containing drilling mud in a well comprising:
introducing a first plug into one end of the casing;
introducing cement into the one end of the casing to apply pressure to the first plug to force it downwardly in the casing to displace the mud from the casing;
providing at least two axially spaced wipers on the first plug so that, as the first plug passes downwardly in the casing, it wipes the inner surface of the casing of any

COPY

accumulated mud, wherein as a wiper on the first plug closest to the one end of the casing wears, the pressure will be applied to the other wiper of the same plug;
terminating the step of introducing the cement into the casing;
introducing a second plug into the casing end;
applying pressure to the second plug to force it downwardly through the casing so that it forces the cement and the first plug downwardly in the casing;
establishing a differential pressure across the first plug to open the first plug and allow the cement to pass through the first plug and exit the other end of the casing; and
providing at least two axially spaced wipers on the second plug so that, as the second plug passes downwardly in the casing, it wipes the inner surface of the casing of any accumulated cement, wherein as a wiper on the second plug closest to the one end of the casing wears, the pressure will be applied to the other wiper of the same plug.

81. The method of claim 80 wherein one of the wipers of each plug overlaps the other wiper of the same plug.
82. The method of claim 80 wherein the wiper of each plug closest to the one end of the casing is overlapped by the other wiper of the same plug.
83. The method of claim 80 wherein each wiper is sized to engage the inner surface in a manner so that it is deflected into a substantially cylindrical wiping engagement with the inner surface.
84. The method of claim 80 wherein the first and second plugs are identical.
85. The method of claim 80 further comprising providing a shearable insert across a central opening in the first plug for closure thereof and adapted for shearing and opening the central opening in the first plug when a predetermined pressure is applied across the shearable insert, and further comprising providing a substantially non-shearable insert across a central opening in the second plug for substantially permanent closure of the opening in the second plug.

COPY

86. The method of claim 80 wherein the step of applying pressure to the second plug comprises introducing a fluid into the casing.
87. The method of claim 80 wherein the second plug forces the cement from the casing into an annulus formed between the casing and the well.
88. The method of claim 80 further comprising providing a float shoe in the casing which stops the downward movement of the first plug and causes the differential pressure.
89. A method for wiping the inner surface of a casing comprising:
providing a plug in the casing having at least two axially-spaced and overlapping wipers to engage and wipe the inner surface; and
applying pressure from one end of the casing to move the plug within the casing.
90. The method of claim 89 wherein the wipers are acutely angled with respect to a longitudinal axis of the plug.
91. The method of claim 89 wherein the wiper closest to the one end of the casing is overlapped by the other wiper.
92. The method of claim 89 further comprising providing an insert across a central opening in the plug for closure thereof, wherein the insert is a shearable member adapted for shearing and opening the central opening when a predetermined pressure is applied across the shearable member or a substantially non-shearable member adapted for substantially permanent closure of the central opening.
93. The method of claim 89 further comprising:
providing an additional plug in the casing having at least two axially-spaced and overlapping wipers to engage and wipe the inner surface; and
applying pressure from one end of the casing to move the additional plug within the casing.

COPY

94. The method of claim 93 wherein the plugs are identical.
95. The method of claim 93 wherein the wipers on each plug are acutely angled with respect to a longitudinal axis of the first plug.
96. The method of claim 93 wherein the wiper closest to the one end of the casing is overlapped by the other wiper on each plug.
97. The method of claim 93 further comprising providing a shearable insert across a central opening in one plug for closure thereof and adapted for shearing and opening the central opening when a predetermined pressure is applied across the shearable insert, and further comprising providing a substantially non-shearable insert disposed across a central opening in the other plug for substantially permanent closure of the latter opening.
98. A method for cementing a casing containing drilling mud in a well comprising:
introducing a first plug into one end of the casing;
introducing cement into the one end of the casing to force the first plug downwardly in the casing to displace the mud from the casing;
providing at least two axially-spaced wipers on the first plug so that, as the plug passes downwardly in the casing, it wipes the inner surface of the casing of any accumulated mud;
terminating the step of introducing the cement into the casing;
introducing a second plug into the casing end;
forcing the second plug downwardly through the casing so that it forces the cement and the first plug downwardly in the casing;
establishing a differential pressure across the first plug to open the first plug and allow the cement to pass through the first plug and exit the other end of the casing; and
providing at least two axially spaced wipers on the second plug so that as the second plug passes downwardly in the casing, it wipes the inner surface of the casing of any accumulated cement; and

COPY

sizing each wiper so that the wiper of each plug closest to the one end of the casing is overlapped by the other wiper of the same plug.

99. The method of claim 98 wherein the first and second plugs are identical.

100. The method of claim 98 further comprising providing a shearable insert across a central opening in the first plug for closure thereof and adapted for shearing and opening the central opening in the first plug when a predetermined pressure is applied across the shearable insert, and further comprising providing a substantially non-shearable insert across a central opening in the second plug for substantially permanent closure of the opening in the second plug.

101. The method of claim 98 wherein the second plug is forced downwardly in the casing by introducing a fluid into the casing.

102. The method of claim 98 wherein the second plug forces the cement from the casing into an annulus formed between the casing and the well.

103. The method of claim 98 further comprising providing a float shoe in the casing which stops the downward movement of the first plug and causes the differential pressure.

104. A cementing plug for use in a cementing casing in a well comprising:
a plug having a longitudinal axis;
a first wiper extending radially outwardly from the plug at an acute angle with respect to the longitudinal axis of the plug;
a second wiper extending radially outwardly from the plug at an acute angle with respect to the longitudinal axis of the plug and disposed in an axially spaced relation to the first wiper;
wherein the second wiper overlaps the first wiper in an axial direction so that the outer surfaces of the wipers portions together extend continuously along the axial length of the body member before the plug is inserted in the casing; and

COPY

wherein the wipers deflect into substantially cylindrical, wiping engagement with an inner surface of the casing when the plug is inserted in the casing.

105. The plug of claim 104 wherein the plug comprises a body member having an elastomeric jacket disposed therearound and wherein the first and second wipers are integrally formed with the jacket.

106. The plug of claim 104 wherein the jacket comprises a cylindrical portion surrounding the body member and is integrally formed with the wipers.

107. The plug of claim 104 wherein the body member is cylindrical and wherein the jacket has a through bore for receiving the body member.

108. The plug of claim 104 further comprising an insert disposed across a central opening in the plug for closure thereof, wherein said insert is a shearable member adapted for shearing and opening the central opening when a predetermined pressure is applied across the shearable member or a substantially non-shearable member adapted for substantially permanent closure of the central opening.

109. A cementing plug for use in a cementing casing in a well comprising:
a plug having a longitudinal axis;
a first wiper extending radially outwardly from the plug at an acute angle with respect to the longitudinal axis of the plug;
a second wiper extending radially outwardly from the plug at an acute angle with respect to the longitudinal axis of the plug and in an axially spaced relation to the first wiper so that when the plug is inserted in one end of the casing and pressure is applied to the plug to force it downwardly through the casing, the wiper portions wipe the inner surface of the casing; and
wherein as the wiper closest to the one end of the casing wears, the pressure will be applied to the other wiper.

COPY

110. The plug of claim 109 wherein the plug comprises a body member having an elastomeric jacket disposed therearound and wherein the first and second wipers are integrally formed with the jacket.

111. The plug of claim 109 wherein the jacket comprises a cylindrical portion surrounding the body member and is integrally formed with the wipers.

112. The plug of claim 109 wherein the body member is cylindrical and wherein the jacket has a through bore for receiving the body member.

113. The plug of claim 109 further comprising an insert disposed across a central opening in the plug for closure thereof, wherein said insert is a shearable member adapted for shearing and opening the central opening when a predetermined pressure is applied across the shearable member or a substantially non-shearable member adapted for substantially permanent closure of the central opening. --